

March 18, 1952

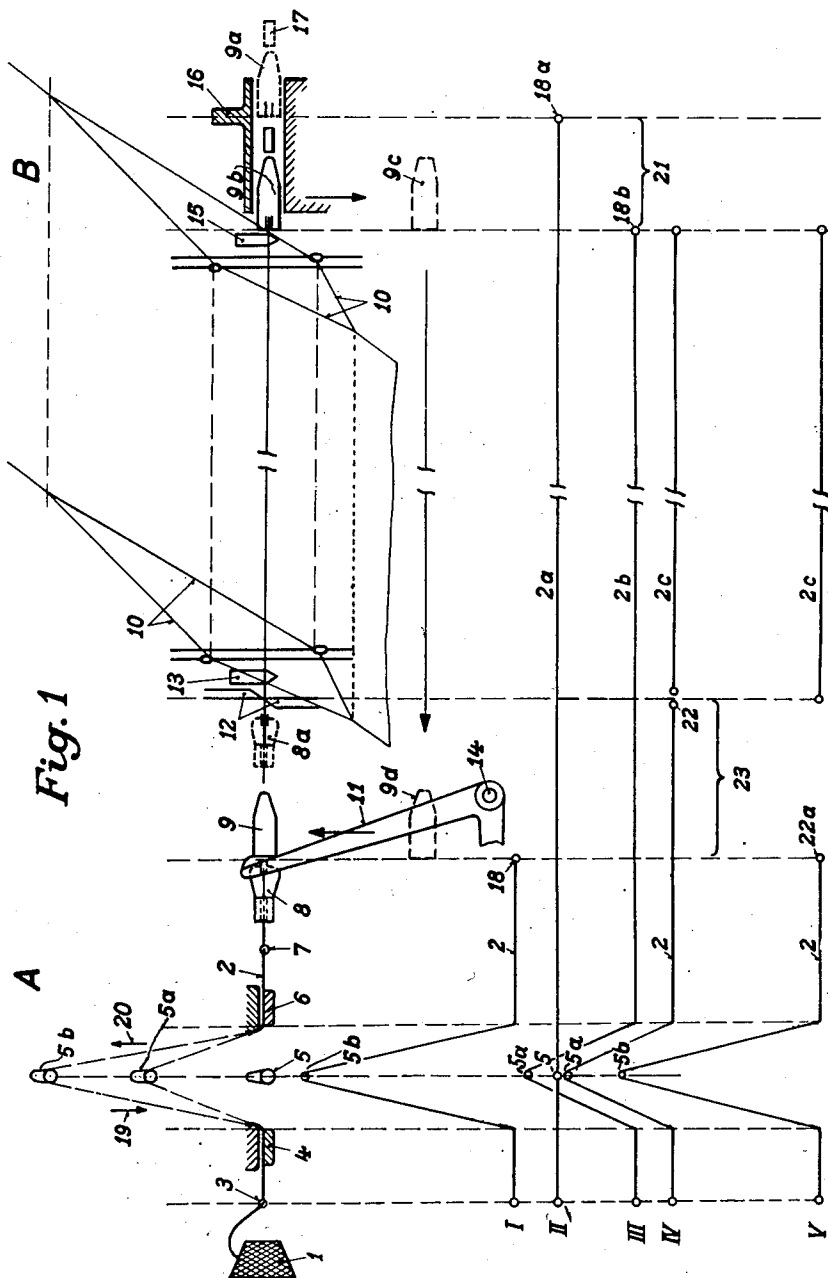
E. PFARRWALLER

2,589,429

DEVICE FOR TENSIONING THE WEFT THREAD IN LOOMS

Filed Nov. 20, 1946

4 Sheets-Sheet 1



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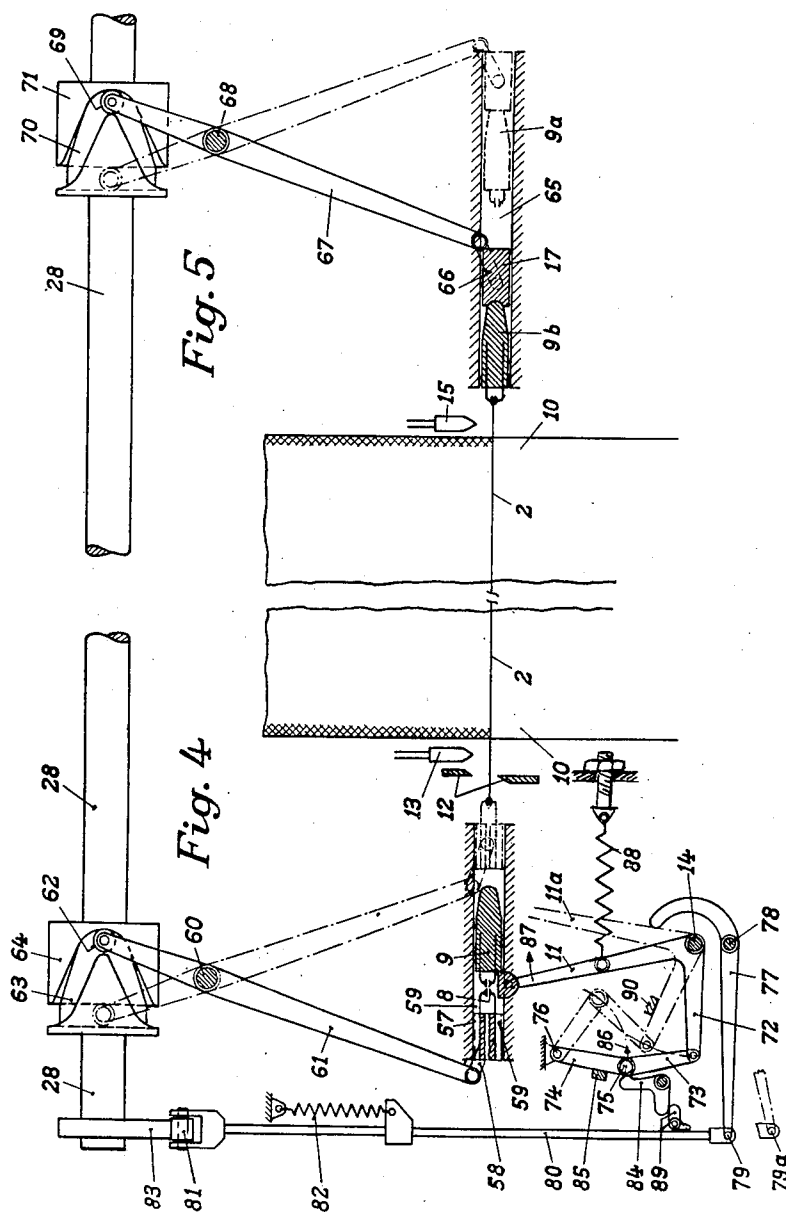
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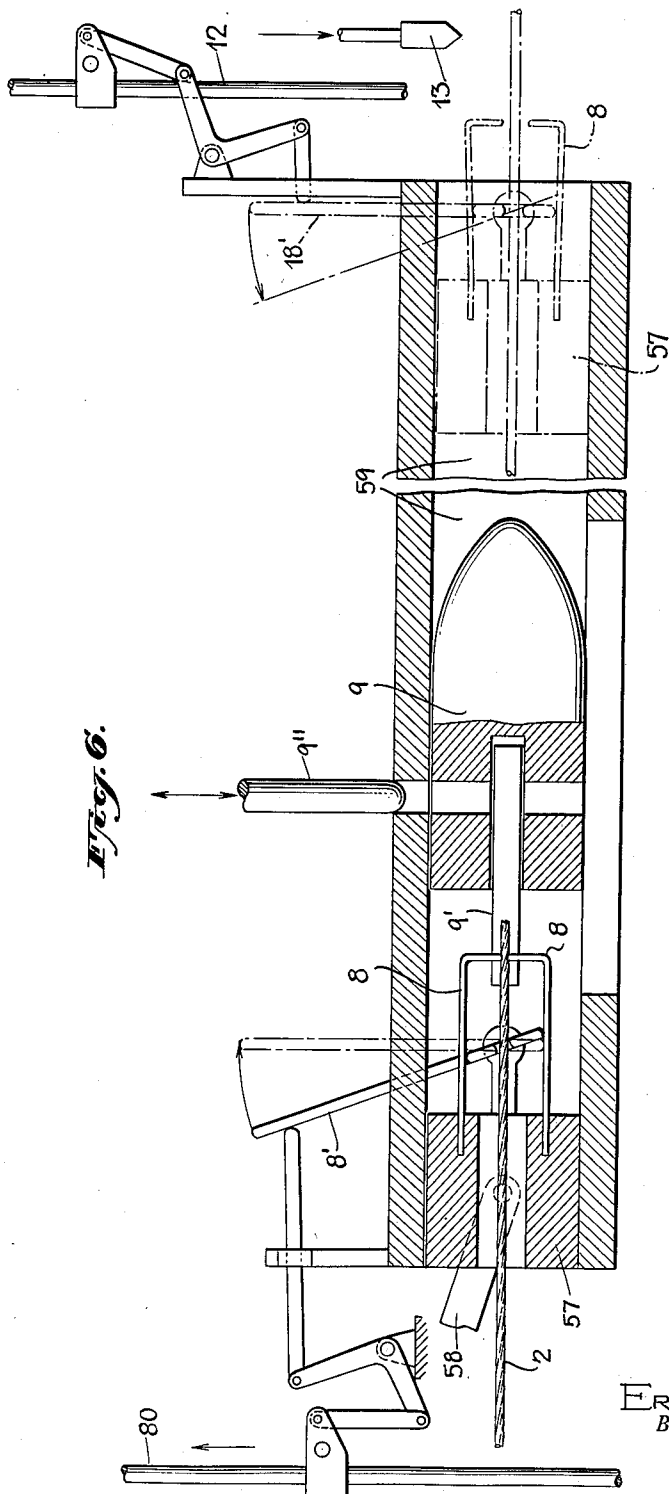


Fig. 6.

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UNITED STATES PATENT OFFICE

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DEVICE FOR TENSIONING THE WEFT
THREAD IN LOOMSErwin Pfarrwaller, Winterthur, Switzerland, as-
signor to Sulzer Freres, Societe Anonyme, Win-
terthur, SwitzerlandApplication November 20, 1946, Serial No. 711,100
In Switzerland November 24, 1945

18 Claims. (Cl. 139-126)

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The present invention relates to a method and means for tensioning the weft thread in a loom.

Among the objects of the invention are to tension yarn or thread in a gripper shuttle loom in order to give the desired quality or characteristic to the finished cloth, to accomplish the tensioning reliably at relatively high speed and in coordination with the operations performed by other parts of the loom mechanism, to present tensioned yarn for the beat-up operation, and to control weft-tension and draw off yarn from the bobbin simultaneously. In carrying out the method, so much of the weft thread is pulled back at the inlet side of the shed that not only is the desired thread tension obtained, but also weft thread is drawn off from the supply bobbin. The method may be carried out by means of a pull-back device arranged at the inlet side of the shed, this device being controlled by the loom drive in such a way that weft thread material is not only drawn back from the shed, but also drawn from the bobbin.

Further and other objects of the present invention will be hereinafter set forth in the accompanying specification and claims and shown in the drawings which, by way of illustration, show what I consider to be preferred embodiments of my invention.

In the drawings:

Fig. 1 is a diagram explanatory of the method of weft-thread insertion in accordance with the invention, showing the movements of the weft thread and representing schematically one form of mechanism which may be employed in performing the method.

Fig. 2 is a part sectional view of a detail of the mechanism according to the invention, the section being taken along line X—X in Fig. 3;

Fig. 3 is a top view of the detail shown in Fig. 2;

Figs. 4 and 5 are part-sectional side views of another detail of the mechanism according to the invention.

Fig. 6 is a diagrammatic illustration of a mechanism forming part of the system shown in Fig. 4.

In performing the method in accordance with a preferred form thereof, on a loom of the gripper shuttle type, a source of weft thread material such as a bobbin 1 is provided outside of the shed. As shown schematically in Fig. 1, the bobbin 1 is arranged at the picking side A of the loom, which is the entry side of the shed 10. The end 13 of the thread is projected through the shed 10 to the receiving side B. In order that

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the end 13 may be projected readily through the shed 10, a loop is formed in the portion of the thread between the bobbin 1 and the end 13 before the end 13 is projected through the shed. This loop is represented in diagram I of Fig. 1 by a portion of the thread extending to the point 5b. As the end 13 is projected to the point 13a, as shown in diagram II, the loop is taken up and additional thread is drawn from the bobbin 1.

If a shuttle such as a gripper shuttle 9 is employed for projecting the thread end 13 through the shed 10, there tends to be some overshoot, which is irregular. For the sake of uniformity, the end 13 is brought back to a fixed point shown at 13b in the diagram III. The resulting slack is taken up by forming a small loop and drawing the thread back to the point 5a. The thread is then gripped by a holding and positioning device 3 at the entry side of the shed 10 and severed at the point 22, by a cutting device whereupon the weft thread is beaten into the shed while it is still under tension, the cut ends having been held. The shed is then closed and a new shed is formed. The thread end 22 is then returned to the point 22a by said holding and positioning device and attached to a new shuttle and released by said holding device preparatory to being projected again through the next shed. In return the thread end 22 to the point 22a, the size of the loop in the portion of the shed between the bobbin 1 and the end 22a is increased by drawing the thread back to the point 5b, shown in diagram V of Fig. 1. The increase in size of the loop is such that not only is the distance 23 between the points 22 and 22a taken up, but additional material is also drawn from the bobbin 1 in forming the loop of increased size.

The loop to the point 5b is preferably released at the same rate as the end 13 is drawn out for projection through the shed 10 so that no slackness in the thread is permitted to develop. Preferably, after the material of the loop has been taken up in projecting the shuttle 9 with the thread end 13 through the shed 10, sufficient braking is applied to the thread drawn from the bobbin 1 to maintain the same tension.

The mechanism shown in Fig. 1 includes in addition to the bobbin 1, a guide eye 3, a first thread brake 4, a thread pull-back 5, and a second thread brake 6. Beyond the brake 6 is a further guide eye 7 followed by a shuttle-feeding weft-thread gripper also called a holding and positioning device 3 which serves the weft thread

end 18 to the shuttle 9. The weft thread from the bobbin 1 is threaded successively through the guide eye 3, the brake 4, the pull-back 5, the second brake 6, and the guide eye 7. The end 18 of the thread 2 is secured to the shuttle-feeding weft-thread gripper 8 for attachment to the shuttle 9 which holds the end 18 of the weft thread 2 while it is being inserted into the shed 10. The holding and positioning device 8 may be constructed according to Figs. 1 to 4 of the U. S. Patent No. 2,163,760 to A. Moessinger. On the pin 14 is mounted the picking stick 11, which is shown in detail in Fig. 4 and is operatively connected with the loom drive; by means of this stick the shuttle 9 is picked through the shed 10 and moves past the thread cutter 12 and past the thread clamp 13 before entering the shed 10. At the shuttle receiving side B of the loom the shuttle 9 passes another thread clamp 15 before it enters the shuttle brake 16, where it comes to rest in position 9a.

Since it is difficult to bring the shuttle 9 which arrives at great speed at the side B, exactly into the position which corresponds to the position of the weft thread 2 before it is beaten into the fabric, the shuttle 9 is permitted to move beyond the ultimate position of the end of the weft thread by a distance 21 which is not necessarily constant. The shuttle 9 is then pushed back into its proper end position 9b, within the shuttle brake, by means of a pushing device 17 which may be coupled to the loom drive as shown in Fig. 5. After the shuttle 9 has released the weft thread 2 when in its end position 9b, it is brought out of the picking path into a position 9c and then carried back into the position 9d, from where it comes again into the picking path to effect another insertion of the weft thread 2 into the shed 10. For effecting the aforescribed movements of the shuttle a mechanism may be used as disclosed in United States Patent No. 2,420,380 of May 13, 1947.

The operation of the parts described so far is as follows:

The thread brakes 4 and 6 are opened when the shuttle 9 is picked into the shed 10. The thread pull-back device 5 is in its extreme outside-position 5b while the thread 2 takes up the position indicated by I in Fig. 1. The end 18 of the weft thread 2 is firmly gripped by the shuttle 9. When the shuttle is picked by means of picker 11 the thread pull-back device 5 begins to move inward in the direction of the arrow 19. The picker 11 and the thread pull-back device 5 are operatively interconnected and the back swinging motion of the thread pull-back device is effected in dependence on the time of the pick or on the picking speed of the shuttle by a mechanism, for example as shown in Figs. 2 and 3.

The inward-movement of the thread pull-back device 5 may be of such an extent that the reserve length of weft thread released thereby corresponds approximately to the first part of travel of the shuttle 9 which is only a fraction of the total length of an inserted weft thread. In order to ensure coordination of the inward-movement of the thread pull-back device and of the picking movement or of the picking speed of the shuttle 9, a spring 32, shown in Figs. 2 and 3 is suitably dimensioned and tensioned. Coordination of said functions provides the advantage that bobbin 1 begins to release weft thread only at the moment when the thread pull-back device 5 has arrived in the axis of the picking path

of the shuttle 9; because of this, the weft thread 2, drawn from the bobbin 1 while being inserted into the shed 10, does not deviate from the straight path, or deviates only slightly. As soon as the shuttle 9 arrives at the receiving side B in the shuttle brake 16 and before its speed is slowed down, at least one of the thread brakes 4, 6 comes into operation to prevent the kinetic energy of the moving weft thread 2 from causing a superfluous amount of thread to be drawn from the bobbin 1, which would result in the weft thread running loose inside the shed 10 and forming loops and waves.

When the shuttle 9 comes to rest in the position 9a, the weft thread 2 is in the extended position 2a shown in II in Fig. 1. The thread pull-back device 5, operated for instance by the means shown in Figs. 2 and 3, moves in the direction of the arrow 20, whilst at the same time, with the thread brake 4 closed, the pushing device 17 transfers the shuttle 9 into position 9b and the end of the weft thread 2 from position 18a to 18b as shown in II and III in Fig. 1. The movement of the pushing device 17 which is caused for instance by the means shown in Fig. 5, and the outward movement of the thread pull-back device 5 which may be effected by the mechanism illustrated in Figs. 2 and 3, are coordinated and not only is the thread pull-back device 5 pushed outward by a distance necessary for tightening the weft thread 2 when the weft thread end is moved back from position 18a to 18b, but also more weft thread material is drawn from the stock, i. e. from the bobbin 1 through the brake 4.

The extent of push-back movement of pusher 17 and of swing-out movement of thread pull-back device 5 are so coordinated that the former is smaller than the length of thread pulled out by device 5 minus the clearance between the two brakes 4 and 6. Start and completion of both movements may coincide. However, the grooved member 71 shown in Fig. 5 which will be described later, may be set so in relation to the setting of cam 27 in Fig. 2 that the pull-back device 5 is actuated before actuation of push-back member 17. Members 71 and 27 are both driven by the main shaft of the loom. With this adjustment the thread puller 5 pulls some thread from the supply 1 before it pulls thread back from the shed and tensions it in coordination with the pusher 17. Relative operation of pusher 17 and puller 5 may be so adjusted that both begin to operate at the same time but that, after the thread end has moved from position 18a to position 18b, Fig. 1, and the thread puller 5 has moved from position 5 in operating step II to position 5a in step III, the stroke of puller 5 is not yet completed and that completion of the stroke causes not only tensioning of the weft thread but also pulling of thread from its source of supply. The shuttle brake 16 prevents pulling of the thread end 18, which is held by the shuttle, beyond point 18b.

The tension of the thread 2 in the positions 2a and 2b in Fig. 1 depends on the setting of the brake 4. However, with a more powerful action of brake 4, the tension in the weft thread 2 is greater, and with a weaker braking action it is less. In the position 2b shown in III in Fig. 1, the weft thread 2, adjustably tightened, is gripped by the two edge grippers 13 and 15 and held in position 8a by the device 8; after this the scissors 12 cut the weft thread 2. The cut portion 2c of the weft thread which is in the shed

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10 (IV, Fig. 1) can now be beaten up, while retaining the tension given to it with the help of the brake 4. Through this control of the tension of the weft thread to be beaten up into the fabric, the quality of the fabric can be influenced greatly and suited to the use for which it is intended.

The device 8, which was moved into position 8a by means, for instance as shown in Fig. 4 and operated by the loom drive, returns the new end 22 of the weft thread 2 by the length 23 to position 22a, whilst at the same time the thread pull-back device 5 moves from position 5a in the direction of the arrow 20 into the position 5b, as illustrated in IV and V in Fig. 1. The speed at which the device 8 moves back from the position 8a into the initial position and the speed at which the thread pull-back device 5 moves from 5a to 5b, are coordinated and in this phase of operation not only is the weft thread 2 securely held under tension by the brake 4 and the device 8, but also additional weft thread material is drawn from the bobbin 1 through the closed brake 4 which retards the movement of the thread but does not stop it.

Thereby, also in this phase of operation, illustrated by IV and V in Fig. 1, a tension in the weft thread is created and maintained which is dependent on the setting of the brake 4. As soon as the end of weft thread 2, which is drawn back from shed 10 and away from brake 4, arrives at position 22a, it is clamped to the shuttle 9 which has returned from the position 9d into its picking path and a new operating cycle, i. e. the insertion of a new weft thread into the shed can take place. Upon movement of pull-back device 5 to the line of movement of the thread during the pick, a supply of loose thread is made available facilitating acceleration of the shuttle and preventing jerks on the thread running off the bobbin.

The described method not only prevents any wear on the thread in the weaving operation, but the thread is also better protected and the quality of the fabric can be controlled. The braking of the weft thread 2, with the shuttle 9 in the receiving brake 16 and at the return motion of the weft thread 2, may be effected by brake 4 alone which is arranged between the bobbin 1 and the thread pull-back device 5, or by the two brakes 4 and 6. If two brakes are used, they may be coordinated with respect to the time at which they operate and to the intensity of their operation.

As shown in Figs. 2 and 3, the thread pull-back device 5, diagrammatically illustrated in Fig. 1, may be provided with a one-arm swinging lever 24 which is pivoted on a stationary pin 25. The free end of the lever 24 is fitted with a hook 26, through which the weft thread 2 passes. A cam follower 29 is rotatably mounted on the lever 24 by a pin 30. This cam follower cooperates with a cam 27, which is fixed on the shaft 28 of the loom drive. A piston rod 33 is pivotally attached to the lever 24 and extends into a cylinder 35. A piston 31 is fixed to rod 33 within cylinder 35 and loaded by a pressure spring 32 resting on an adjusting screw in the cover of the cylinder. In the lower part of the cylinder 35 a bore 34 is provided which is covered by the piston 31 when the latter approaches its lowest end position.

Movement of the pull-back device 24, 26 in the direction of the arrow 20 to the extreme outward position 24a, shown in dash-dot lines, is effected by the cam 27 against the action of the spring 32,

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which is tensioned by the piston 31 moving toward its upper end position. The run-off side 27a of the cam 27 is so steep, i. e. radial, that the inward movement of the pull-back device 24, 26 in the direction of the arrow 19 is effected solely under the action of the spring 32 and is independent of the speed of the drive shaft 28 and therefore also independent of the speed of the loom drive.

Since not only the speed of the moving-in motion of the thread puller 24 but also the picking speed of shuttle 9 are independent of the speed of rotation of the loom drive, the former speed may be coordinated to the initial picking speed of the shuttle by proper adjustment of the initial tension of spring 32, Fig. 2, and spring 88, Fig. 4, to be described later, and the length of thread pulled by the shuttle at the beginning of the pick is provided by the moving-in motion of the thread puller without withdrawal of thread from the supply 1.

Shortly before the pull-back device 24, 26 reaches its initial position, whereby the weft thread 2 is brought back into the picking line (Fig. 1), the movement of the pull-back device 24, 26 is pneumatically retarded, the piston 31 covering the bore 34, whereby the air under the piston 31 can escape only slowly or not at all, and is therefore compressed.

Return motion of the pull-back device 24, 26 into the initial position by a force whose magnitude is independent of the loom drive, such as a spring, is particularly recommended when the shuttle 9 is picked by a force whose magnitude is also independent of the loom drive, for example by the use of a picking device as shown in Fig. 4. On the other hand, if the pick of the shuttle 9 is effected by means of a cam operated by the loom drive, it is preferable to control the weft release movement of the pull-back device, i. e. movement of lever 24, 26 from the extreme outward position 24a into the initial position, by a cam or an eccentric drive instead of by spring 32.

The brakes 4, 6 shown diagrammatically in Fig. 1 have each a brake arm 36 as shown in Figs. 2 and 3 which is pivoted on the fixed pin 37 and provided with a tension spring 48. On each brake arm 36 a brake shoe 38 is arranged which is pressed under the action of the tension spring 48 to a soft body which is held taut, for instance to the braking belts and the brake shoe 38. The endless braking belts 39 extend around a driving roller 40 and a tension roller 41. The two driving rollers 40 are fixed on a shaft 42 provided with a ratchet wheel 43 into which fits a pawl 44. The pawl is connected to a tipping lever 46 by means of pin 45: the tipping lever 46 is pivotably mounted on stationary pin 47. The tipping lever 46 and the swinging lever 24 are pivotably connected to the operating rod 49. Each swinging motion of the lever 24 causes a rotary motion of the driving roller 40, whereby the brake belts 39 are intermittently moved relatively to the brake shoes 38. In this way concentration of wear at a single point of the braking belts 39 by the weft thread 2 when it is periodically pressed by the brake shoes 38 to the belts 39 is effectively prevented.

The tension rollers 41 are carried with their pins 50 in forks 51 which swivel on shaft 52. Each fork 51 is under the action of a tension spring 53 whose pull can be adjusted by means of screws 54 for setting the tension of the brake belts 39 and consequently the braking action on the weft thread 2.

In each of the two brake arms 36 a cam fol-

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lower 56 is fitted by means of a pin 30' and is pressed against a cam 55 by the action of the springs 48. The two cams 55 are fixed on the shaft 28 of the loom drive. The motion of the brake shoe 38 and the outward motion of the pull-back device 24, 26 in the direction of the arrow 20 are dependent on the motion of the cams 55 and 27 respectively and are thereby dependent on the speed of the loom drive. The timing of the motions of the pull-back device 24, 26 and of the brake arms 36 with respect to each other is determined by the relative position of the cams 27 and 55 and may be changed by altering their relative positions. With this arrangement it is not only possible to adjust the brake force acting on the weft thread by suitably increasing or diminishing the tension in the braking belts 39, but also to adjust these brake pressures within each operating cycle by suitably shaping the cams 55 and setting their relative positions. The method and device described above assures careful treatment of the weft thread 2 and reduction of the risk of its breaking on its way from the bobbin 1 to the shed 10, as well as adjustment and maintenance of the tension when the weft thread 2 is beaten up into the fabric.

Fig. 4 illustrates the positioning device 8, which, as shown diagrammatically in Fig. 1, transfers the weft thread end 22 from position IV to position V (22a). Device 8 is held by a guide piece 57 which is slidably supported between the guides 59 arranged on two sides of the shuttle 9. The guide piece 57 is connected to a driving lever 61 pivoted on the fixed pin 60 by a link member 58. At one end of the lever 61 a cam follower 62 is arranged running in cam groove 63 of a control cylinder 64. The control cylinder 64 is mounted on the shaft 28 of the loom drive. By suitably shaping of cam groove 63 and a relative proportioning of the length of the arms of the lever 61, the movement of device 8 may be made to accord with the movement of the thread pull-back device 5 which is also dependent on the driving shaft 28, in such a way that during its moving out from the position IV to position V (Fig. 1), not only is the length of thread required for keeping the weft thread tight drawn back from the shed, but weft thread material is also drawn off from the bobbin 1. This is accomplished by adjustment of the mechanism for operating the pull-back device, Fig. 2, and the mechanism for operating the thread gripping and positioning device 57, 8, Fig. 4, in such manner that the stroke of member 5 (26) is not yet completed when that of device 8 is completed, or that member 5 begins to move before device 8 has brought the thread end 22 into the position 22a. Duration of action of both motions may be the same.

Fig. 6 is a diagrammatic illustration of a weft thread gripping and positioning device as may be used in the mechanism according to the present invention. One the left side of Fig. 6, the device is shown in the position shown on top of Fig. 1 and designated by 22a at the bottom of said figure. In this position the grippers 9' of shuttle 9 have just been closed on the thread 2 and the thread is still held by the grippers 8 of the positioning member 57. Up-stroke of rod 80 preliminarily to the release of the shuttle picking means causes clockwise movement of the gripper-opening lever 8' as indicated by arrows in Fig. 6. When this lever reaches a position at right angle to the longitudinal axis of the grippers, the lat-

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ter are opened and permit the shuttle to move to the right trailing a weft thread. Member 57 is then also moved to the right to the position and in the condition shown on the right side of Fig. 6, i. e. with the grippers open. When the pick is completed, the thread cutter 12 comes into action and closes the grippers 8 prior to severing the thread. Downward movement of a cutting member 12 causes member 8' to be turned counter-clockwise as indicated by arrows on the right side of Fig. 6. After the thread has been cut, device 57, firmly holding the thread, is returned to the left side of Fig. 6 by the mechanism shown in Fig. 4. The grippers of the shuttle to which the thread must be connected are held open by a pin 9'' which is inside guide channel 59 when the shuttle is moved into the channel to assume the position in which it is shown in Fig. 6. The pin is withdrawn for closing clamps 9' upon the thread 2. The mechanisms shown in Fig. 6 are conventional and are illustrated only because such mechanisms are suitable for use in a mechanism according to the invention.

The picker 11 is pivoted on the shaft 14 and is provided with an arm 72 which is joined to a link 73. Through the joint 75 the link 73 is connected to a second link 74, which is pivoted on a stationary pin 76. A tensioning lever 77 swings about a pin 78 and is fulcrumed at its end 79 to a push rod 80. The push rod 80 has at its free end a cam follower 81 which is pressed to a cam 83 by means of tension spring 82 attached to the push rod 80; the cam 83 is fixed on shaft 28 of the loom drive. Push rod 80 is provided with an abutment 89. This cooperates with one arm of bell-crank lever 84, whose second arm acts on the joint pin 75. A strong tension spring 88 acts on the picker 11; it imparts the necessary acceleration to the picker 11 when picking.

In Fig. 4 the position is shown which the picking device takes up shortly before the shuttle 9 is picked. If now the shaft 28 of the loom drive rotates, the push rod 80, due to the pulling action of the spring 82, moves upwards to follow a corresponding movement of the cam 83. The stop 89 presses on the bell crank lever 84, the movement of which presses the lever pair 73, 74 into its extended position and then in the direction of the arrow 86 into flexed position whereby spring 88 is released and the picker 11 accelerated in the direction of the arrow 87. The shuttle 9 is moved thereby at great speed between the open thread cutters 12 and past the thread gripper 13 into the shed 10, whilst the picker 11 comes to rest in the position 11a because of a stop 90. The cam 83 then presses the push rod 80 down against the action of springs 82 and 88, whereby the tensioning lever 77 is swivelled into position 79a and the spring 88 is tensioned. This causes not only straightening of the link pair 73, 74 but also imparts sufficient kinetic energy to cause it to come to rest on a stop 85 in a position slightly flexed toward lever 84. Further rotation of the cam 83 permits push rod 80 to be moved upward by the spring 82 into the intermediate position shown in the drawing whereby the tensioning lever 77 is swivelled out of the path of motion of the picker 11 and the latter remains locked in the position ready for the pick. Further upward moving of the push rod 80 caused by the spring 82 and the position of the cam 83 initiates the next pick.

In the same manner as the device 8 in Fig. 4 the pushing device 17, shown in Fig. 5, can be actuated from the shaft 28 of the loom drive.

The pushing device 17 moves the shuttle 9 from its ultimate position 9a back to position 9b. The pusher member 17 travels in a guide 65. To the pushing device 17 a link member 66 is jointed which is connected to an operating lever 67. The operating lever 67 is supported by a pin 68 and has at its free end a cam follower 69. The latter fits into a cam groove 70 in a control cylinder 71. This control cylinder 71 is fixed on the shaft 28 of the loom drive. As in the case of the drive shown in Fig. 4 the shape of the cam groove 70 and the ratio between the length of the two arms of the lever 67 may be chosen in such a way, that in spite of the weft thread moving from position II to position III (Fig. 1) in addition to the length of thread needed for tightening the weft thread, also some weft thread material is drawn off from the bobbin 1 by the thread pull-back device 5.

While I believe the above described embodiments of my invention to be preferred embodiments, I wish it to be understood that I do not desire to be limited to the exact details of design and construction shown and described, for obvious modifications will occur to a person skilled in the art.

I claim:

1. In a loom for weaving, the combination of drive means, a stationary source of weft thread supply, a shuttle, two positively actuated weft thread retarding means, weft thread pull-back means disposed between said retarding means and moving substantially reciprocatingly and transversely to the line connecting said retarding means and forming a substantially triangular loop in the weft thread, substantially reciprocatingly moving shuttle push-back means moving the shuttle toward the shed after completion of the pick, said pull-back and said push-back means as well as said retarding means being connected with and operated by said drive means, the stroke of said push-back means being shorter than the length of weft thread in the loop formed by said pull-back means minus the distance between said retarding means, and said pull-back means pulling additional thread from said source.

2. In a weaving loom of the type having a weft thread bobbin, a shuttle movable substantially in a line away from the bobbin for carrying thread through a shed, and a loom drive shaft, the combination comprising a thread pull-back lever between the bobbin and the shed having a hook through which thread is adapted to pass, a cam on said drive shaft engaging said lever for oscillating the lever synchronously with drive shaft rotation in a plane transverse to the line of motion of the shuttle, a weft-thread brake between the bobbin and the pull-back lever, having a brake surface and a movable brake shoe between which thread may pass, and a cam on said drive shaft engaging said brake shoe for oscillating said brake shoe synchronously with said drive shaft rotation, said brake being so located relative to the thread hook of the said pull-back lever that the brake forms a guide for the thread causing the thread to form a loop while said hook moves away from the line of motion of the shuttle.

3. In a weaving loom of the type having a weft thread bobbin, a gripper shuttle movable substantially in a line away from the bobbin for carrying thread through a shed, and a loom drive shaft, the combination comprising cam means on the shaft, a shuttle-feeding weft-thread gripper disposed between said bobbin and the shed

and guided to move in the line of movement of the shuttle and having operating mechanism driven by said cam means, said mechanism serving to translate rotary motion of the shaft into reciprocating movement of the said gripper toward and from the shed, a thread pull back lever between the bobbin and the weft-thread shuttle-feeding gripper, having a part through which thread is adapted to pass, and a cam on said drive shaft engaging said lever for oscillating the lever synchronously with drive shaft rotation in a plane transverse to the line of motion of the shuttle, said cams being so located on said shaft that the part of the said pull-back lever, through which the thread passes, moves away from the line of motion of the shuttle while the said gripper holds the thread and moves it away from the shed.

4. In a weaving loom of the type having a loom drive shaft, a weft thread bobbin, and a shuttle movable substantially in a line away from the bobbin for carrying thread through a shed, the combination comprising a shuttle picker at the side of the shed near the bobbin, actuating mechanism for the shuttle picker, a cam on said drive shaft engaging said picker actuating mechanism, a shuttle push-back lever at the far side of the shed, a cam on said drive shaft engaging said lever for moving the shuttle back to a fixed position from an overshot position, a thread pull-back lever between the bobbin and the near side of the shed having a hook through which thread is adapted to pass, a cam on said drive shaft engaging said pull-back lever for oscillating the lever synchronously with drive shaft rotation in a plane transverse to the direction of motion of the shuttle, a weft-thread brake between the bobbin and the pull-back lever, having a brake surface and movable brake shoe between which thread may pass, and a cam on said drive shaft engaging said brake shoe for oscillating said brake shoe synchronously with said drive shaft, said cams being so located that the thread hook of the said pull-back lever moves away from the line of motion of the shuttle as the shuttle-push-back lever moves the shuttle at the far side of the shed to its fixed position, and while the thread brake shoe is moved to the brake surface for retarding run-off of weft thread from the bobbin while said hook pulls on the thread for taking up the slack caused by the back-movement of the shuttle, without stopping said run-off.

5. In a loom for weaving, the combination of loom drive means, a source of weft thread supply, warp threads forming a shed, a weft thread pull back mechanism disposed at the side of the shed where the weft thread enters it when being inserted and including a cam rotated by said loom drive, a lever having an end portion adapted to engage a weft thread, a cam follower mounted on said lever and engaging said cam, and spring means holding said cam follower to said cam, the pulling of the weft thread being effected in positive relation to the configuration of the cam.

6. In a loom for weaving a weft thread pull back mechanism as defined in claim 5, said cam being so formed as to positively move said lever in a direction for pulling the weft thread and to afford return movement of said lever to inactive position by means of said spring.

7. In a gripper shuttle loom having loom drive means, a source of weft thread supply, and warp threads forming a shed, the combination of a weft thread pull back device disposed at the side of the shed where the weft thread enters it when

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being inserted and connected to and positively driven by said loom drive, and of a weft thread gripping and positioning device guided to move exclusively in the line of the weft thread entering the shed and disposed at the same side of the shed as said pull back device and also connected to and driven by said loom drive to move reciprocatingly at interdependent timing with said pull back device.

8. In a loom for weaving, the combination of loom drive means, a shuttle, a shuttle picking mechanism comprising resilient means periodically tensioned by said drive means and released and picking thereby the shuttle with an accelerating force independent of said drive means, a weft thread pull-back mechanism comprising actuating means connected to and operated by said loom drive means and comprising other resilient means tensioned upon actuation of said pull-back mechanism by said actuating means and released and returning thereby said pull-back mechanism to inactive position by a force independent of said drive means, and individual adjusting means connected individually with said resilient means and controlling their tension.

9. In a loom for weaving, the combination of loom drive means, a shuttle, a shuttle picking mechanism comprising resilient means periodically tensioned by said drive means and released and thereby picking the shuttle with an accelerating force independent of said drive means, and a weft thread pull-back mechanism comprising actuating means connected to and operated by said loom drive means and comprising other resilient means tensioned upon actuation of said pull-back mechanism by said actuating means and released and returning said pull-back mechanism thereby to inactive position by a force which is independent of said drive means.

10. In a loom for weaving, the combination of drive means, a stationary source of weft thread supply, picking means, weft thread pull-back means, weft thread motion retarding means, said three last mentioned means individually comprising actuating means connected with and actuated by said drive means and operated at interdependent timing, said actuating means being so constructed as to release said retarding means at the start of the pick and to apply same before completion of the pick.

11. In a loom for weaving, the combination of drive means, a stationary source of weft thread supply, picking means, weft thread pull-back means, weft thread motion retarding means, said three last mentioned means individually comprising actuating means connected with and actuated by said drive means and operated at interdependent timing and being adapted to release said retarding means at the start of the pick and to apply same substantially simultaneously with the completion of the pick.

12. In a loom for weaving having loom drive means, a source of weft thread supply, warp threads forming a shed, the combination of a weft thread pull-back device and a weft thread motion retarding device, both devices being disposed and acting on the weft thread between said source and the side of the shed where the weft enters when being inserted, and a mechanism connected to and driven by said drive means and connected to and positively actuating both said devices at interdependent timing and being so constructed as to afford withdrawal of weft thread in a direction away from the shed

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and simultaneous withdrawal of weft thread from said source.

13. In a loom for weaving having loom drive means, a source of weft thread supply, warp threads forming a shed, the combination of a weft thread pull-back device and a weft thread motion retarding device, both devices being disposed and acting on the weft thread between said source and the side of the shed where the weft enters when being inserted, a mechanism connected to and driven by said drive means and connected to and positively actuating both said devices at interdependent timing, said retarding device comprising two clamping means spaced along the line of movement of the weft thread toward the shed and engaging the thread, and said pull-back device having a member disposed between said means and movable transversely to the line of movement of the thread toward the shed for pulling the thread to form substantially a triangle when said member is moved from said line of movement, the corners of the triangle being formed by flexing the thread at said means and at said member.

14. In a weaving loom having warp threads forming a shed, a source of weft thread supply disposed outside the shed, a shuttle transporting weft thread from said source through the shed, and a loom drive, the combination comprising a weft thread pull-back device disposed between said source and one side of the shed and engaging the weft thread and being adapted to pull weft thread from the shed and also from said source, a shuttle push-back device disposed on the other side of the shed for pushing the shuttle from an overshot position back to a fixed position, actuating means individually connected with said pull-back and with said push-back device and with the loom drive and being adapted to actuate said push-back device to push the shuttle back toward the shed and to simultaneously actuate said pull-back device to pull weft thread back from the shed and to pull weft thread from its source.

15. In the combination with a loom as defined in claim 14, a weft thread gripping and positioning means disposed between said pull-back device and the shed, weft thread severing means disposed between said positioning means and the shed and severing the weft thread after it has been gripped by said gripping and positioning means, actuating means connected with said positioning means and the loom drive and moving said positioning means with a gripped weft thread away from the shed, the actuating means of the pull-back device being adapted to continue actuation of the pull-back device after said push-back device has stopped for taking up the slack in the weft thread caused by the movement of said positioning means from the shed and also to pull thread from said source.

16. In a weaving loom of the type having a weft thread bobbin, a gripper shuttle movable substantially in a line away from the bobbin for carrying thread through a shed, and a loom drive shaft, the combination comprising cam means on the shaft, a shuttle-feeding weft-thread gripper disposed between said bobbin and the shed and guided to move in the line of motion of the shuttle and having an operating mechanism driven by said cam means, said mechanism serving to translate rotary motion of the shaft into reciprocating movement of the said gripper toward and from the shed, a thread pull-back lever between the bobbin and the weft-thread shuttle-

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feeding gripper, having a part through which thread is adapted to pass, and a cam on said drive shaft engaging said lever for oscillating the lever synchronously with drive shaft rotation in a plane transverse to the line of motion of the shuttle, a weft-thread brake between the bobbin and the pull-back lever having a brake surface and a movable brake shoe between which thread may pass, and a cam on said drive shaft engaging said brake shoe for oscillating said brake shoe synchronously with said drive shaft, said cams being so located on said shaft that the part of the said pull-back lever, through which the thread passes, moves away from the line of motion of the shuttle while the said gripper holds the thread and moves it away from the shed and said brake affords simultaneous pulling of thread from the bobbin.

17. In a loom for weaving having warp threads forming a shed, a source of weft thread supply disposed outside of the shed, loom drive means, and gripper shuttles, the combination of picking means for said shuttles, a weft thread pull-back device, weft thread cutting means, and a weft thread holding and positioning device guided to move in the line of movement of said shuttles, said devices being connected with and interdependently operated by said drive means, said holding and positioning device being adapted to move the end of a weft thread from the shed toward said source after it has been cut by the cutting means after the pick and said pull-back device being adapted to pull back the moved weft thread and to pull an additional length of weft thread from said source.

18. In a loom for weaving, the combination of weft threads forming a shed, a source of weft thread supply disposed outside of the shed, loom

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drive means, picking means, a weft thread pull-back device, weft thread cutting means, a weft thread holding and positioning device, and actuating means interconnecting said devices and said drive means for interdependent operation thereof and being adapted to actuate said holding and positioning device to move the end of a weft thread from the shed toward said source after it has been cut by said cutting means after the pick and to actuate said pull-back device to pull back the moved weft thread and to simultaneously pull an additional length of weft thread from said source.

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